Conference on Aerospace and Space Science Technology

An Extraordinary Year for Managing Technology

Daniel L. Dumbacher, Deputy Director
Exploration Launch Office
NASA Marshall Space Flight Center

July 24, 2006

Introduction

It's wonderful to be back home again in Indiana. I am honored to be here with you today to share two important results of effective technology management. The first is the indirect return on investment that Americans get from NASA's relatively lean annual budget, and the second is the direct economic benefits that the great state of Indiana and businesses nationwide realize through multiple contracts with NASA. As a proud Purdue graduate and deputy director of one of NASA's highest-priority, multi-billion dollar projects, I have a vested interest in this conference and in the outcome of this work.

My goal today is to help you better understand the types of work in which NASA engages and to provide avenues for you to pursue opportunities with America's space Agency, if that is a good fit for your company. You may already know that NASA and various Indiana businesses and universities are partners in the pursuit of improving life on Earth through scientific discoveries that pay dividends in terms of expanded knowledge, as well as big-picture conveniences and a multitude of spin-offs. Whether your organization is large or small, NASA offers numerous opportunities to participate.

Before I provide some motivating facts and figures about the aerospace industry and its economic impact, I want to set the stage by sharing several notable examples of how 2005 was an extraordinary year for technology management at NASA, a subject that I can speak about firsthand.

Background

To set the context for the business of technology, it is helpful to know more about the NASA's management team and guiding principles. In April 2005, Congress confirmed Dr. Mike Griffin as NASA's Administrator. Dr. Griffin is a private pilot who holds seven academic degrees. He actually wrote the book on spacecraft design and has a proven technology management track record with both the Government and private sectors.

Dr. Griffin's commitment to balancing technical performance with budget guidelines and schedule targets is reflected in the management team he has assembled across the Agency and in a number of inventive ways of doing business available at NASA, including the Centennial Challenges Programs for non-traditional sources of innovation and the Commercial Orbital Transportation Services initiative for International Space Station missions. At the conclusion of my talk, I will provide selected resources that you can use to research these and other opportunities with NASA.

The U.S. Vision for Space Exploration provides the Agency's goals and objectives, including retiring the Space Shuttle, finishing the International Space Station, and fielding safe, reliable space transportation systems to ensure America's access to space. About a year ago, the Agency conducted the Exploration Systems Architecture Study and subsequently stood up the Exploration Launch Projects office in September 2005 to design and develop a new generation of human-rated and heavy-lift space transportation systems to continue the journey of discovery through the unique vantage point of space.

A New Age of Exploration

One thing I have learned over two decades of experience with human-rated, automated, and experimental launch vehicles is that space travel is a complex, risky proposition, but one that is well worth the effort if managed correctly.

Our nationwide launch vehicles team is focused on delivering cost-effective transportation solutions that will enable the Agency to more fully invest its finite resources on the "why" of exploration, rather than on the "how". This is what we call a systems approach to rocket science — that is, never losing sight of the outcome, which is sustainable exploration for the decades ahead.

Over the last year, the resources have been assembled to begin the process of replacing the Shuttle as soon as possible after it is retired in 2010, and to return astronauts to the Moon by 2020. In the foreseeable future, the first human footprint will be placed on Mars. At this juncture, we must fully meet the intent of the Vision for Space Exploration and the U.S. Space Transportation Policy, which outline the nation's security, economic, and technological strategic goals and objectives relative to space. The stakes are high. We cannot afford to be second best.

Passport to Knowledge

Before giving you a brief list of technology management achievements that NASA and its partners in industry and academia have realized over the last year, let me point out that, although this conference may be focusing on the INCOME, I am more focused on the OUTCOME. Again, this is the "systems thinking" process that results in a product that is greater than the sum of its parts — be it hardware or software, a launch vehicle or a science experiment.

By better understanding NASA's overall mission, it is my hope that you, as an entrepreneur, can better align your organization's capabilities to help meet stakeholder requirements and provide solutions to the challenges astronauts will face as they strike out to explore the fertile territory of space. It is our pioneering spirit that has given us glimpses into other worlds, through telescopes peering back into time, and through robotic rovers on Mars. But the human brain is not yet obsolete.

Without a doubt, it is the combination of man and machine that will give us the greatest capacity to learn the secrets of our planetary neighborhood, starting with a return to the Moon, to begin a new era of discovery where we left off over 3 decades ago. The Lunar Reconnaissance Orbiter will launch in 2008 to map the surface of the Moon and search for future landing sites, building on the 1994 Clementine mission and the 1998 Lunar Prospector mission that revealed ice within the Moon's craters. Technologists and scientists are planning how this precious resource can help sustain astronauts living and working on Earth's closest neighbor. For example, the Marshall Space Flight Center recently worked with Purdue University to develop systems that can be used to help land spacecraft safety and create habitats for human explorers.

Although this is a journey, not a race, we are not alone in our interest in exploring the Moon and Mars. There are many compelling reasons to undertake this endeavor at this time, not the least of which is leadership. When I was younger, I experienced excitement and inspiration from knowing that Americans could travel to and from the Moon. It affected me so profoundly that I made space my life's work. I believe that one of the greatest benefits of our 7th trip to the Moon will be a renewed interest in math and science among new generations of explorers who will steer our future course as a nation and as the people of Earth.

So how do we regain that capability? Learning from hard-won past and present lessons is a start. To recap, 2005 was an extraordinary year for technology management, including:

- Over 5 years of continuous crewed operations on the International Space Station.
- The Space Shuttle's return to flight.
- The Mars Exploration Rovers continued studying the red planet well into their second year, far beyond their expected 90-day lifetimes
- The Mars Reconnaissance Orbiter is in low orbit on a mapping mission.
- The Cassini spacecraft reached Saturn and dropped the Huygens probe into the atmosphere of its largest moon Titan, discovering that it is remarkably Earth-like.
- The Deep Impact spacecraft traveled over 250 million miles to comet Temepl 1 and returned the best-ever comet data and images.
- The Hubble Space Telescope discovered that Pluto may have three moons.
- The Spitzer Space Telescope captured the first light ever detected from two planets orbiting stars other than the Sun.
- Voyager 1 entered our solar system's final frontier after traveling over 8 billion miles.

Although we often hear about dramatic failures in the media, it is my opinion that successes such as these far outweigh short-sighted opinions of the value of aerospace investment. This list is just the tip of a scientific agenda aimed at answering compelling questions such as:

- How the Sun affects life on Earth.
- How to predict changes in the Earth's system of land, oceans, atmosphere, and life.
- How human activity is affecting conditions on Earth.
- How to protect astronauts on long-duration missions and how to apply this knowledge to diseases back on Earth.
- How to improve aeronautics by using unique NASA facilities.
- How to maintain America's leadership in space through international cooperation.

Results-Oriented Consumer Benefits

I hope that these few examples will help you see that, ultimately, it is the overall results that matter. What I am talking about are not only the far-reaching discoveries that rewrite school children's textbooks and help us think in totally new ways about our everyday lives, I am also talking about the multitude of daily conveniences we take for granted, such as satellites that enable global cell phone communication, internet connections, and commercial-free radio, not to mention pin-point accurate GPS navigation and life-saving storm tracking. Pollution detection, water purification, and medical breakthroughs such as MRIs and CAT scans owe their genesis to space-related challenges of keeping astronauts safe and healthy.

There are literally thousands of Earth-based inventions that began as space-based applications, some that directly affect Indiana's agriculture, trucking, and sports industries. For example:

- Farmers can drive their tractors remotely using technology invented to keep spacecraft on a precise course. While the farmer controls acceleration and braking, the tractor drives in perfectly straight lines and may be used in all phase of farming, resulting in higher crop yields.
- Landsat images provide timely, accurate crop inventories, allowing farmers to better plan for planting and harvesting.
- Car drivers and truckers both benefit from the Traffic Detection System that uses NASA technology developed for Earth-observing satellites to enable a system of sensors that are mounted above traffic on poles or on span wires to alert drivers to dangers ahead.
- NASCAR drivers are protected from extreme heat by a spin-off of the Space Shuttle's thermal protection system, greatly reducing the car's cockpit temperature, which sometimes exceeds 100 degrees.
- Transducers for Indy and NASCAR pushrods and motion control components were developed as an offshoot of strain gages developed to control mobile robots for NASA applications.
- Temper foam for astronaut seating has made its way into Indy and NASCARs, adding both comfort and shock-absorbing safety.

Doing Business with NASA

While some of these may sound pretty far out, their worth is well documented, leading us new questions: What <u>is</u> the intrinsic value of technology in our lives today and in the future? And how <u>do</u> American's manage to reap the rewards of these and countless other space-related inventions? The answer is clear: Through contracting with businesses and educational institutions, large and small, across the country, space-based technologies often find new purposes in unexpected places.

Whether you are a prime contractor or a subcontractor, an entrepreneur or a college professor, NASA procures goods and services amounting to over $10 billion per year, with many of these contracts awarded to small-business set-asides. NASA contract obligations in Indiana in Fiscal Year 2004 totaled $43 million. Of that, $32 million went to two large businesses — the ITT Corporation and ITT Industries in Ft. Wayne. Of the six contracts that made up this $32 million, five of them were for work at the Goddard Space Flight Center in Maryland and one was for the Langley Research Center in Virginia.

Several Indiana companies also have received Small Business Innovative Research awards, including:

- Space Hardware Optimization Technology of Greenville, which has won several awards dealing with thermal storage.
- P.C. Krause & Associates of West Lafayette won an award for Control of Resonance in a 20KHz Space Power System.
- Zeeko Technologies, also of West Lafayette, won a contract for Edge Control in Large Segmented Optics.

And the NASA network encompasses Indiana universities, including Ball State, Crane/Naval Surface Warfare Center, Indiana University, Purdue, and Notre Dame. Indiana consortium members with NASA work include Clarian Health Partners, the Indiana Industry Forum, the Indiana Information Technology Association, and the Rose-Hulman Institute for Technology, to name a few.

From an accountability standpoint, it is the balancing of technical performance delivered on time and within budget that ensures whatever part you play or provide is ready to integrate into the whole system. For example, NASA is involved in developing a new high-performance engine that will propel astronauts back to lunar orbit. This is but one dimension of a complex launch vehicle system. Likewise, considered in total, it is not just the astronauts, but the ground operators and mission controllers, the scientists and rocket engineers, and the services providers such as journalists, teachers, accountants, and real estate agents who benefit from the aerospace investment that yields exponential dividends.

A study done on the economic benefits of the Apollo space program in the 1960s estimated that $8 was returned for every $1 invested. The Federal Aviation Administration's recent study using 2004 statistics reports that almost $100 billion was generated by the U.S. commercial launch industry and the associated businesses it enables. This includes over 500,000 jobs with $25 billion in direct earnings. Launch vehicle manufacturing rebounded from the FAA's 2002 study because of an increase in commercial launches that included the first suborbital flight of the privately developed SpaceShip One — which is a harbinger of space tourism — and a strong satellite services sector driven primarily by the increase in demand for direct television and remote sensing services.

History shows that great nations of the past have shaped the cultures of today. America's space program will help fuel creativity, innovation, technology development, and leadership. This future is being purchased for about $16 billion, which is less than 1% of the Federal budget. That amounts to just 15 cents per day for the average taxpayer.

Gaining Competitive Advantage

For most of you attending this conference, I imagine that you are wondering exactly how you can improve your competitive advantage in the aerospace industry. To assist you, let me give you a quick primer into how NASA's Fiscal Year 2007 budget is organized and conclude with several references that may prove valuable for your follow-up research.

- NASA's budget is divided into several key areas:
- Science Mission Directorate
- Exploration Systems Mission Directorate
- Aeronautics Research Mission Directorate
- Space Operations Mission Directorate
- Mission Support
- Cross-Agency Support Programs

The last area is where initiatives such as advanced business systems and the innovative partnership programs reside, such as technology transfer and small business innovation research.

NASA is progressive in its business approach. In Fiscal Year 2005, NASA received a "green" rating from the Office of Management and Budget for competing the NASA Shared Services Center for consolidated business activities. NASA also received the President's Quality Award for Innovation and Exemplary Practices for its science competitions.

References for More Information

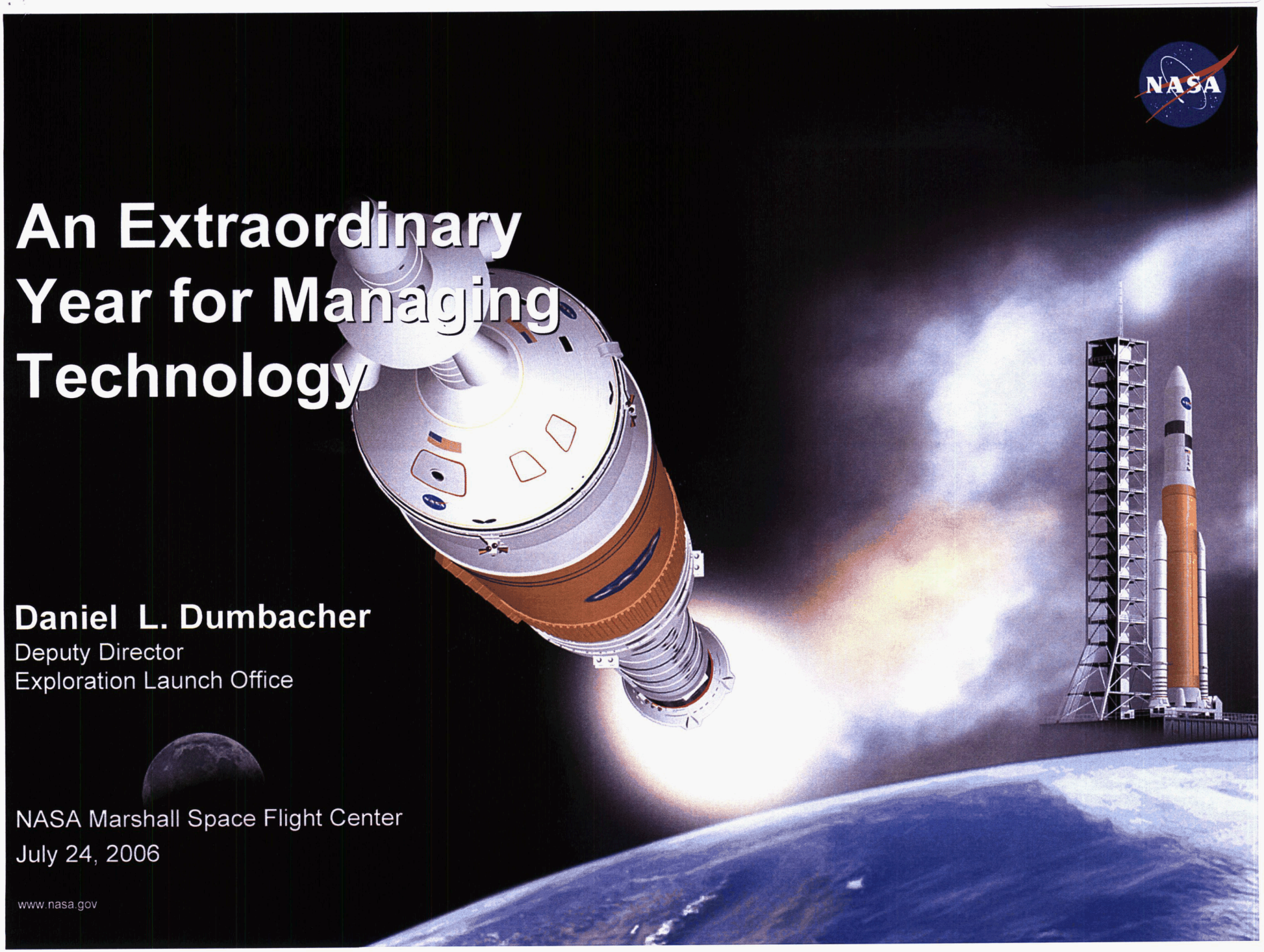
Some of the readily available resources for obtaining more information about NASA's mission and how to do business with NASA include the Innovative Partnerships Program Web site at ipp.nasa.gov, which has information about research partnership centers, university research engineering, and technology institutes; and a host of ways you can determine where your particular brand of talent fits into the NASA picture. The NASA home page at www.nasa.gov is a great launching pad for many of the topics discussed here today.

Conclusion

Delivering value for the taxpayer investment is crucial to sustaining the national will to carry out difficult, yet rewarding missions across multiple political administrations throughout the coming years. U.S. businesses and academia are vital partners in this important work, which will enable our astronaut ambassadors to uncover knowledge unbounded by limitations such as gravity.

I know that some of you in the audience today are involved in this work and that there are others who will make future contributions. By bringing to bear the technological innovation that is unique to American research and development, we can individually and collectively improve life on Earth for generations to come.

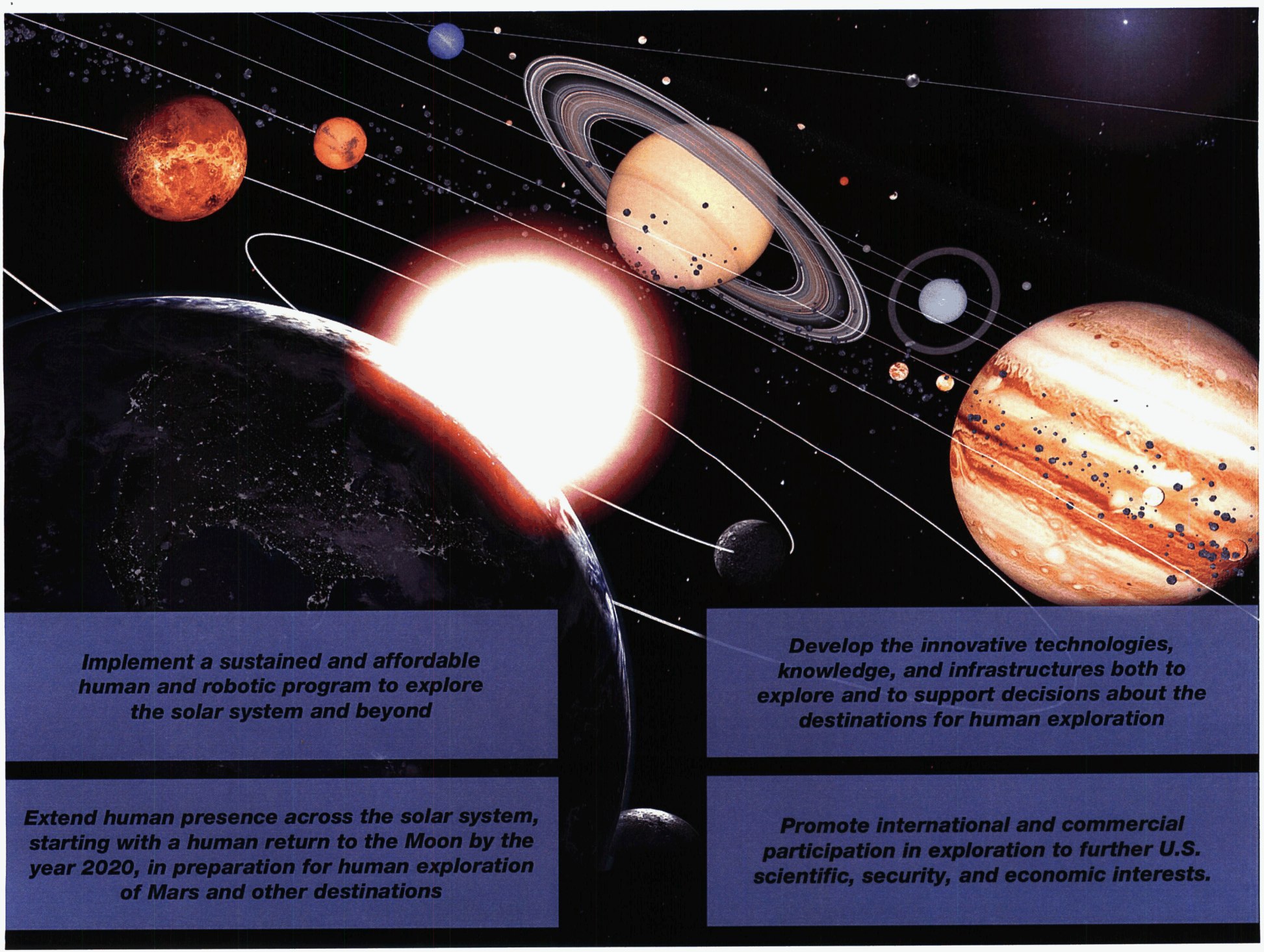
I want to thank the event organizers for the opportunity to spend some time with you today and to share some of the successes of accountable technology management. I hope that this brief background of NASA's missions and how we are organized will inspire you to consider how your Indiana business or university can contribute to America's future in space and prosperity on Earth.



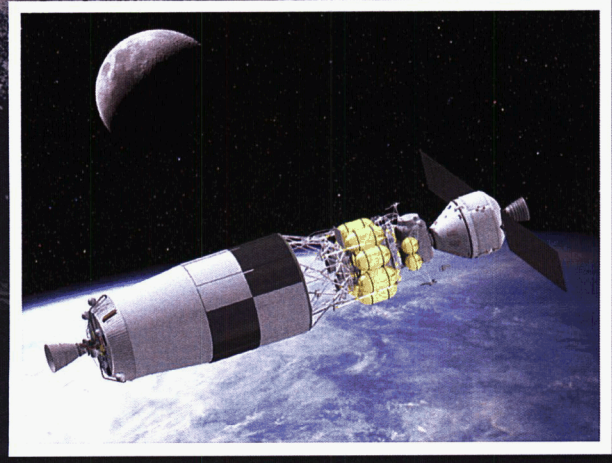
An Extraordinary Year for Managing Technology

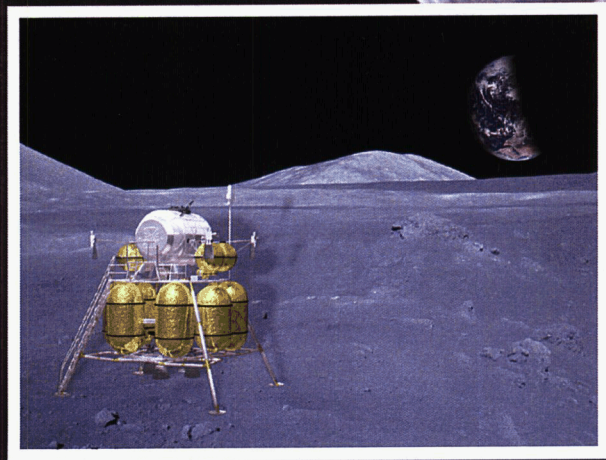
Daniel L. Dumbacher
Deputy Director
Exploration Launch Office

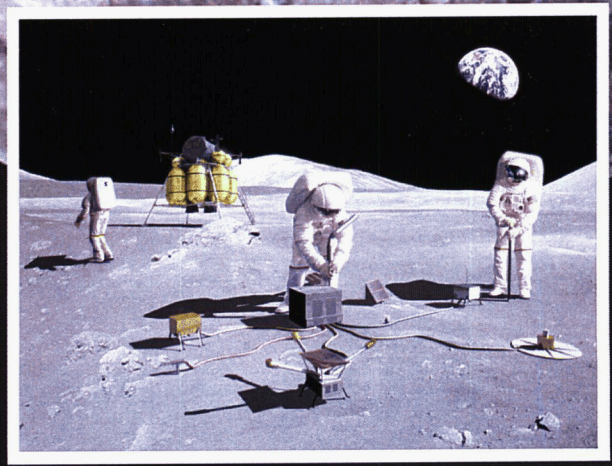
NASA Marshall Space Flight Center
July 24, 2006


Implement a sustained and affordable human and robotic program to explore the solar system and beyond
Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration
Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations
Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests.

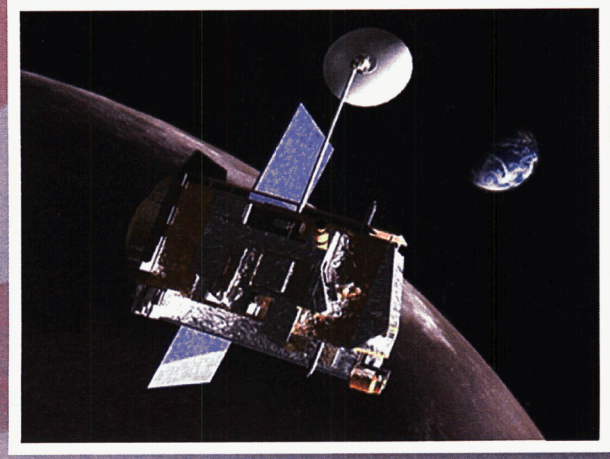
NASA is delivering a more capable exploration infrastructure to secure America's continued role as the leader on Earth and in space.

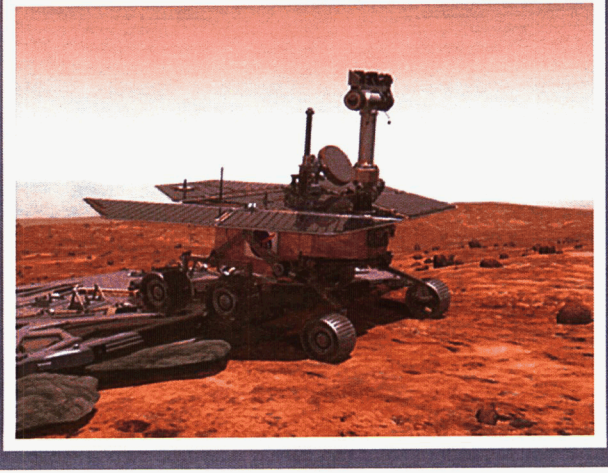


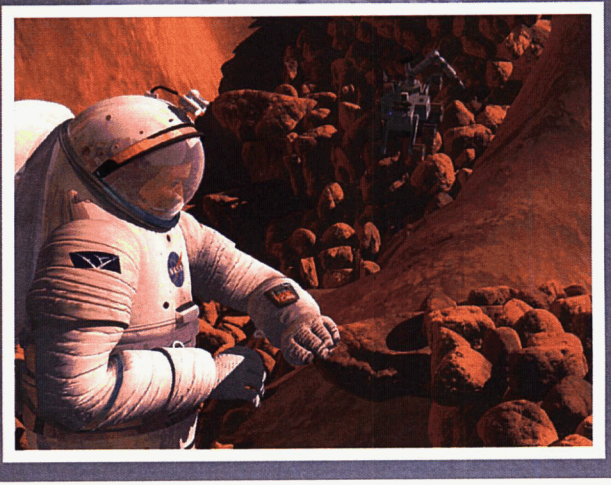




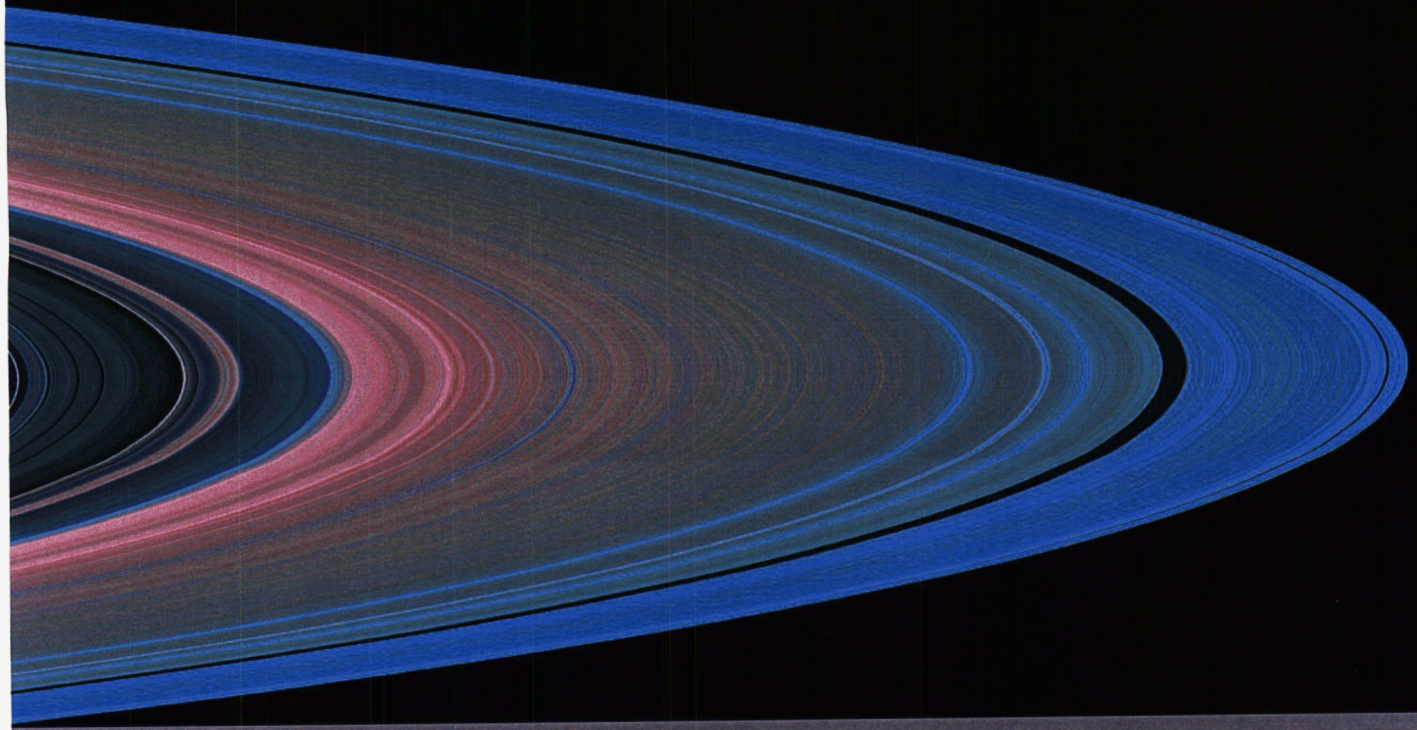
Civil Space Transportation Gives America The Means To Explore, Promoting Our Culture And Values.

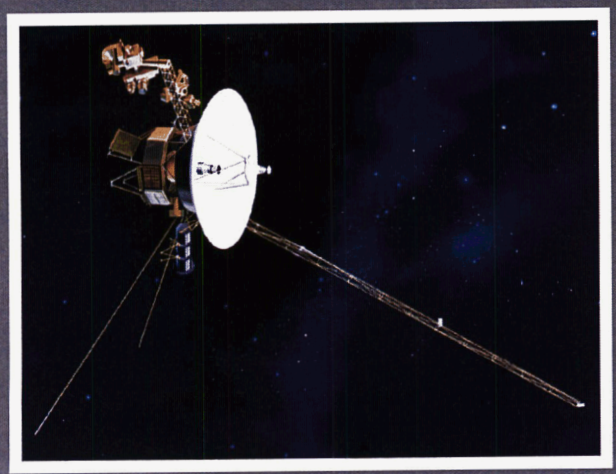


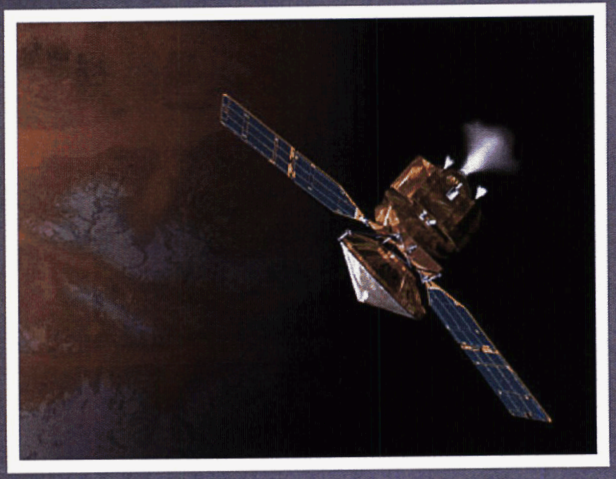


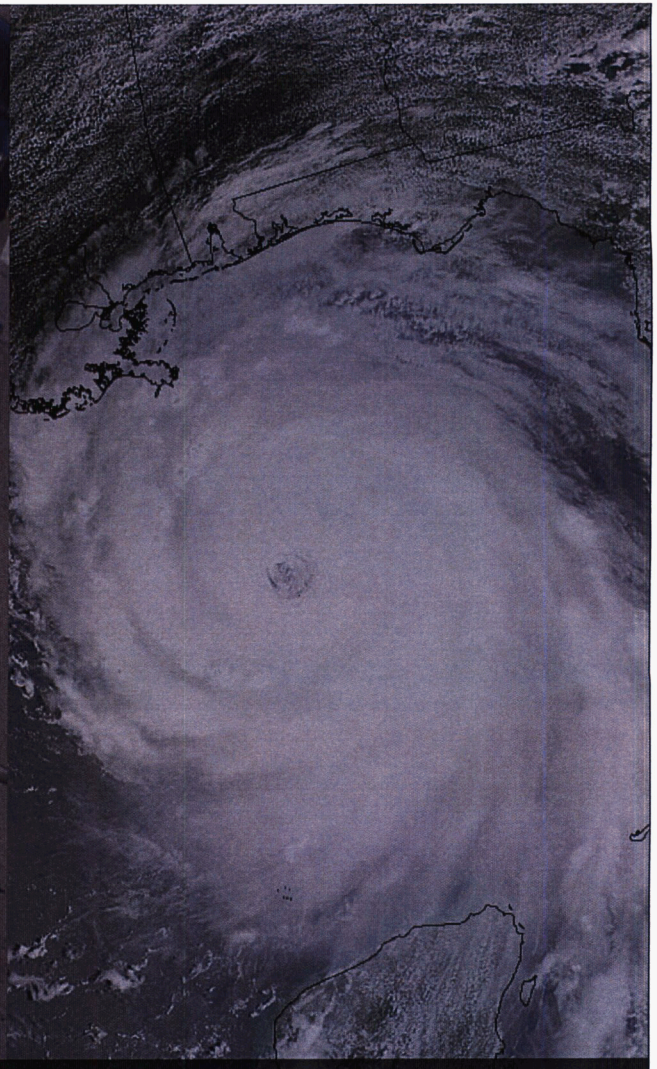


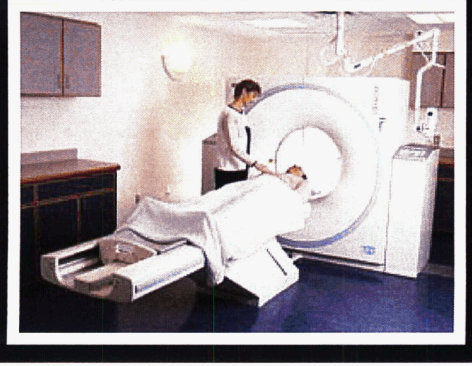
America's drive to explore with the mind and body advances science and technology.



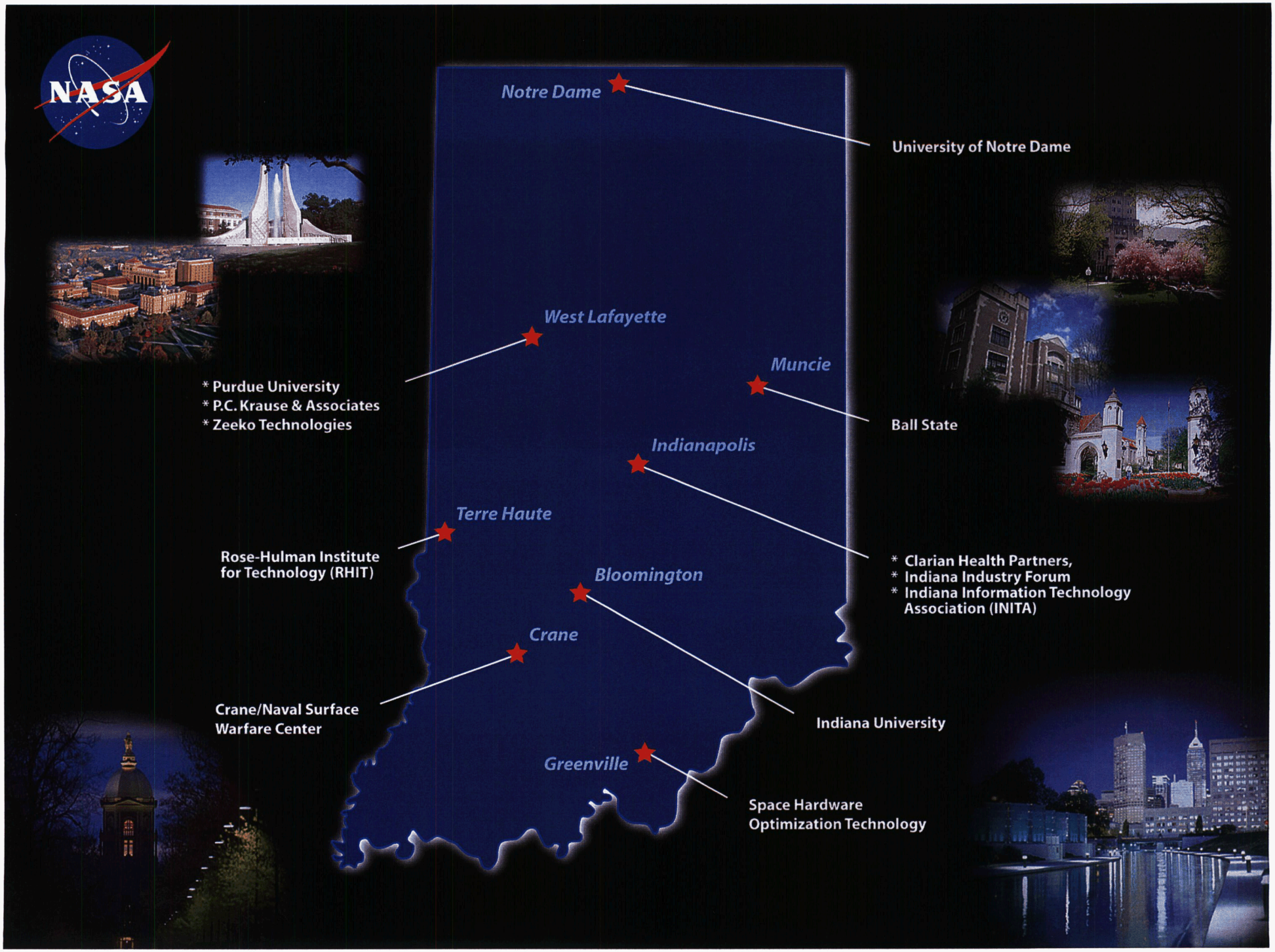








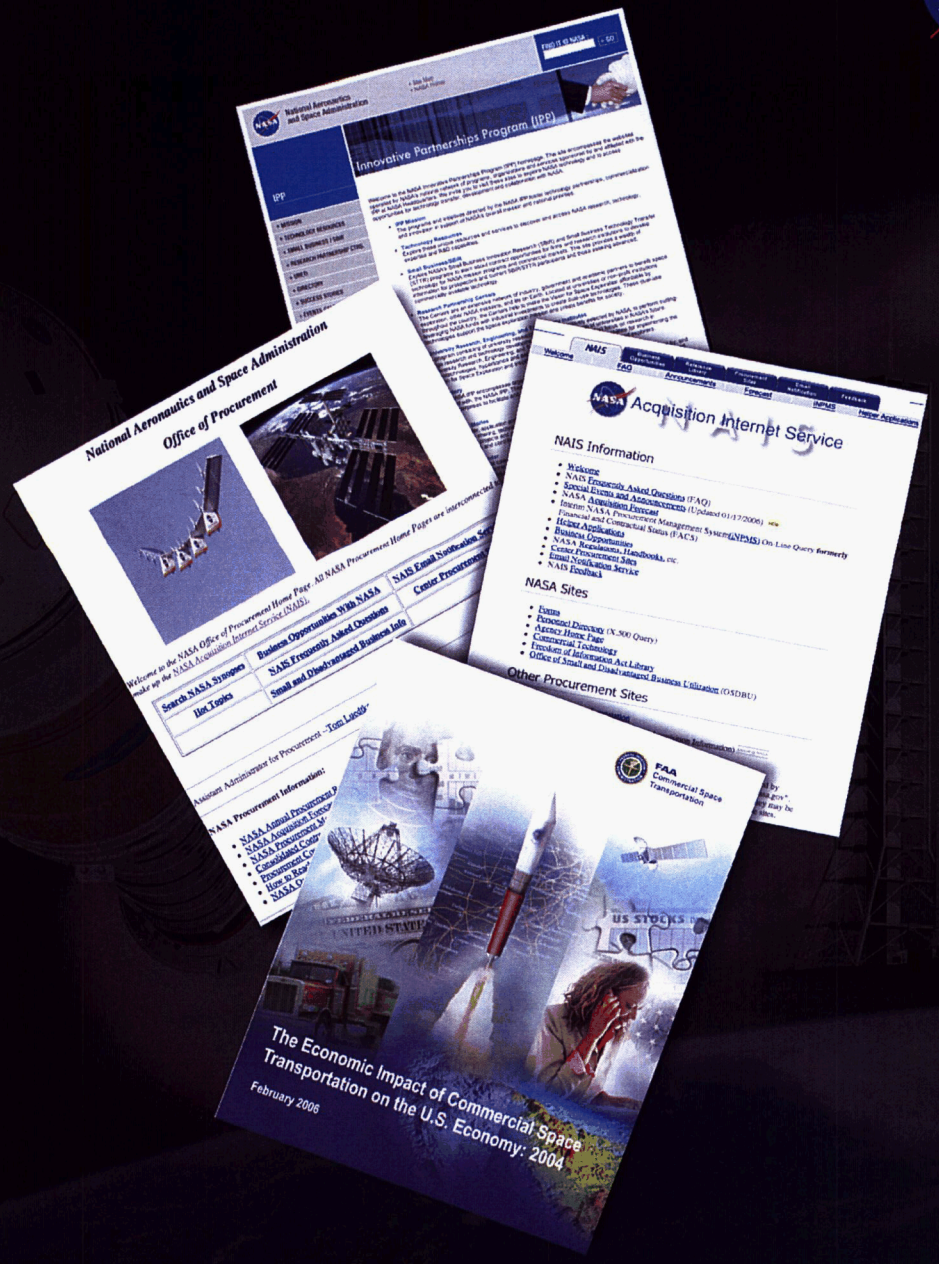

ALLTEL
Mobil 1
DODGE
12
ALLTEL


NASA
Notre Dame
University of Notre Dame
West Lafayette
* Purdue University
* P.C. Krause & Associates
* Zeeko Technologies
Muncie
Ball State
Indianapolis
* Clarian Health Partners,
* Indiana Industry Forum
* Indiana Information Technology Association (INITA)
Terre Haute
Rose-Hulman Institute for Technology (RHIT)
Bloomington
Indiana University
Crane
Crane/Naval Surface Warfare Center
Greenville
Space Hardware Optimization Technology


FAA
Office of Commercial Space Transportation
The Economic Impact of Commercial Space Transportation on the U.S. Economy: 2004
February 2006

References

- http://ipp.nasa.gov/
- http://www.hq.nasa.gov/office/procurement/
- http://prod.nais.nasa.gov/cgi-bin/nais/index.cgi



America's exploration of space promotes National strength and prosperity.